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FROM Theresa A. Lober

PAGES 8
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RE: **Application No. :** 10/612,174
Confirmation No.: 5221
Applicants: Robert K. Reich et al.
Filed: July 2, 2003
Docket No.: MIT8806L
For: High-Speed, High-Sensitivity
Charge-Coupled Device

MESSAGE

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Application No. 10/612,174

Response Dated March 1, 2006

Reply to Examiner's Action of December 2, 2005

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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I hereby certify that this correspondence is
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Kevin A. Quinto
March 1, 2006

RESPONSE

This is in response to the Examiner's Action mailed December 2, 2005.
This response is being sent by facsimile transmission directly to the Examiner's
organization within the three-month shortened statutory period for reply.

The Examiner is thanked for a telephone interview conducted with the
undersigned Agent on Wednesday March 1, 2006. During the interview, the
Examiner and the undersigned Agent discussed the effective filing date of the
instant application and discussed the subject matter of the U.S. provisional
application from which the instant application claims benefit. At the conclusion

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of the interview the Examiner instructed the undersigned Agent to file a written response laying out the points of discussion.

The Applicants hereby request reconsideration of the rejection of the claims.

The claims were rejected under 35 U.S.C. §102(b) as being anticipated by Reich et al., "High-Fill-Factor, Burst-Frame-Rate Charge-Coupled Device," with coauthors Reich, O'Mara, Young, Loomis, Rathman, Craig, Watson, Ulibarri, and Kosicki, International Electron Device Meeting and IEDM Technical Digest, pp. 567-570, December 2001 (hereinafter "Reich '01").

Under 35 U.S.C. §102(b), and explained at MPEP706.02(a) II.A., if the publication date of a reference is more than 1 year prior to the effective filing date of an application, then the reference qualifies as prior art under 35 U.S.C. §102(b).

Under 35 U.S.C. §119(e) and explained at MPEP706.02 V.(D), if an application properly claims benefit under 35 U.S.C. §119(e) to a provisional application, the effective filing date the application is the filing date of the provisional application for any claims which are fully supported under the first paragraph of 35 U.S.C. §112 by the provisional application.

The instant application properly claims benefit under 35 U.S.C. §119(e) to Provisional Application 60/394,125, filed July 3, 2002. The claims of the instant application are fully supported under the first paragraph of 35 U.S.C. §112 by the provisional application. The effective filing date of the instant application is therefore July 3, 2002.

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The publication date of the Reich '01 article, "High-Fill-Factor, Burst-Frame-Rate Charge-Coupled Device," is December 2001. This is less than one year prior to the July 3, 2002, effective filing date of the instant application. The Reich '01 article therefore cannot be applied against the instant application under 35 U.S.C. §102(b). The Applicants respectfully request the retraction of this rejection of the claims.

In the Applicants' response dated September 14, 2005, there was submitted from each co-inventor named in the instant application a Declaration under 37 C.F.R. §1.132 stating that the co-inventors conceived or invented the subject matter of instant application that is disclosed in the Reich '01 article. With the submission of these declarations, the Reich '01 article is also removed as a reference under 35 U.S.C. §102(a).

The Reich '01 article thus cannot be applied against the instant application under any part of 35 U.S.C. §102.

At Page 3 of the Examiner's Action, the Examiner referred to a second Reich article, "Integrated Electronic Shutter For Back-illuminated Charge-Coupled Devices," IEEE Transactions on Electron Devices, Vol. 40, No. 7, pp. 1231-1237, July 1993 (hereinafter referred to as "Reich '93"). But the Examiner did not cite a statutory basis for applying Reich '93 to reject the claims; only Reich '01 is cited in a statutory rejection of the claims. No rejection of the claims based on Reich '93 is found and it is not clear if the Examiner intended to reject the claims over Reich '93.

If the Examiner intended to apply Reich '93 against the claims, such is not warranted. Reich '93 fails to teach or even suggest fundamental aspects of the invention required by the claims.

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Independent claim 1 requires an array of super pixels disposed in a semiconductor substrate, with each super pixel including a plurality of independently-controlled subpixels and each subpixel corresponding to a frame in a sequence of image frames. Reich '93 does not teach or even hint at a configuration of a super pixel or a correspondence between subpixels and a sequence of image frames as required by claim 1.

Claim 1 further requires that the charge collection channel region, the charge drain regions, and the charge collection control layer of each subpixel be characterized by a dopant type and dopant concentration for expanding the charge collection channel region in response to a charge collection control voltage applied to the channel region control electrode, to collect in the charge collection channel region photogenerated charge from the substrate during the image frame corresponding to that subpixel.

Claim 1 additionally requires dopant types and concentrations for the subpixel regions recited just above for contracting the collection channel region in response to a charge storage control voltage applied to the channel region control electrode, to store the collected photogenerated charge in the charge collection channel region and collect substantially no additional photogenerated charge as other subpixels of the super pixel collect photogenerated charge corresponding to other frames of the image frame sequence.

Reich '93 does not remotely teach or even hint at subpixel region dopant types and concentrations that would enable a subpixel to store collected photogenerated charge as other subpixels of a super pixel collect photogenerated charge corresponding to other frames of an image frame sequence.

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As explained in the instant Specification at paragraphs 45-46 and shown in Fig. 3C, with this configuration, the imaging array bias, V_{IA} , can be set to produce a contracted collection region 66, and the applied shutter drain voltage, V_{SD} , can be set to maintain the p-n junction of each shutter drain and the substrate in a reverse biased condition but limited such that the depletion region associated with the reverse biased junction does not extend beyond the p-type buried layer. Under these conditions, photoelectrons in the substrate are repelled from the subpixel collection region and are directed toward other subpixels having an expanded collection region like that shown in Fig. 3B.

This subpixel configuration and control state result in fixed storage of previously-collected charge at a subpixel as illumination continues, with photogenerated charge from the continued illumination being directed away from the subpixel such that no charge is added and the charge store remains substantially fixed. This enables each super pixel to accurately acquire the true image for each frame in an image frame sequence while at the same time storing previously acquired frames of the sequence, for transfer of the frame sequence from the super pixel only after the entire sequence of frames has been collected.

It is the subpixel dopant type and concentration recited in claim 1 that enable this direction of photogenerated charge away from a subpixel storing charge and toward other subpixels collecting charge, so that the super pixel accurately acquires a true image for a given frame while storing charge from other frames for transfer only after the entire sequenced of frames has been collected. Reich '93 does not teach or suggest a subpixel dopant type and configuration for this super pixel operation, let alone any super pixel configuration or operation as required by claim 1.

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Independent claim 10 requires the super pixel configuration recited in claim 1 and further requires that each subpixel in the super pixel include a channel region control voltage connection that is configured for independent collection and storage of photogenerated charge from the substrate at the charge collection channel region of a subpixel during a corresponding frame in the sequence of image frames.

In the invention, each subpixel channel region has a control voltage connection, as shown in Figs. 3A-D, that enables independent collection and storage of photogenerated charge during a corresponding frame in an image frame sequence. As explained above, with this independent control, a given frame image is accurately captured only by a selected subpixel(s) of a super pixel. Each subpixel is independently controlled to enable such.

Reich '93 does not teach or even hint at a subpixel control voltage connection for independent control of a plurality of subpixels for storage of photogenerated charge during a sequence of image frames. Reich '93 does not provide even a suggestion of configuring subpixels and controlling the subpixels independently to acquire a sequence of image frames as required by independent claim 10.

Independent claim 21 requires the super pixel configuration recited in claim 1, and further requires that the number of subpixels included in each super pixel be selected based on the length of an image frame sequence and the frame rate of the sequence, to collect photogenerated charge from each frame in the image frame sequence by at least one corresponding subpixel of the super pixel and store the collected charge at the corresponding subpixel as other subpixels collect photogenerated charge from other frames in the image frame sequence.

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As explained above, Reich '93 does not provide even a suggestion of configuring subpixels to acquire a sequence of image frames. Reich '93 accordingly is devoid of teaching or suggestion as to selection of a number of subpixels based on the length of an image frame sequence and the frame rate of the sequence as required by independent claim 21.

All remaining claims depend from one of independent claims 1, 10, or 21 and include the limitations of such. It is therefore submitted that Reich '93 neither teaches nor suggests the invention of claims 1-24.

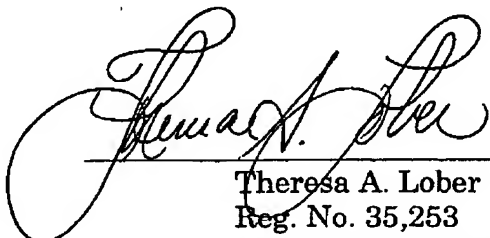
Reich '01 has been removed as a reference under 35 U.S.C. §102(a) by the Applicants' Declarations. Reich '01 cannot be applied as a reference under 35 U.S.C. §102(b) because its publication date is less than one year prior to the effective filing date of the instant application.

The Applicants therefore respectfully submit that the claims are in condition for allowance, which action is requested.

If the Examiner has any questions or would like to discuss the instant application, he is encouraged to telephone the undersigned Agent at his convenience at the phone number given below.

Respectfully submitted,

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